UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **9702/32**

Paper 3 Advanced Practical Skills 2 **May/June 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.
You will be allowed to work with the apparatus for a maximum of one hour for each question.
You are expected to record all your observations as soon as these observations are made, and to plan the presentation of the records so that it is not necessary to make a fair copy of them.
You are reminded of the need for good English and clear presentation in your answers.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

Additional answer paper and graph paper should be submitted only if it becomes necessary to do so.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

You may not need to use all of the materials provided.

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1 In this experiment, you will investigate the time for the voltage across a component to decrease after a switch is opened.

You have been provided with a circuit containing a power supply, switch and a component C, as shown in Fig. 1.1.
Throughout the experiment **do not disconnect this circuit**.

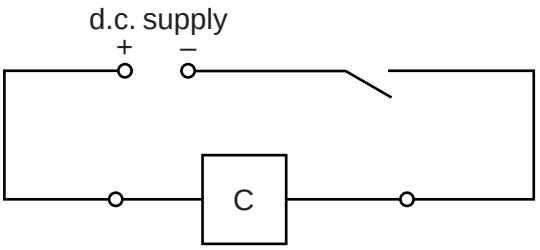

Fig. 1.1

(a) Assemble the circuit of Fig. 1.2 with the 10.0 kΩ resistor clipped into the component holder as resistance *S*.

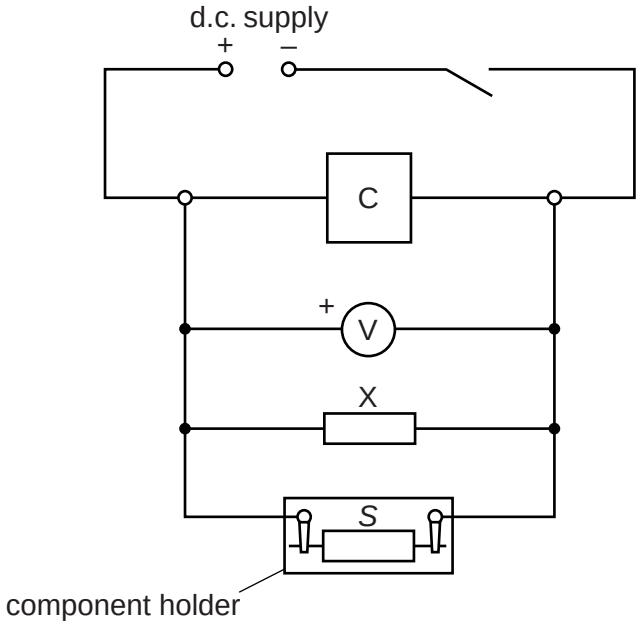

Fig. 1.2

(b) (i) Close the switch and check that the voltmeter reading is between 4V and 8V.

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(ii) When the switch is opened the voltmeter reading will gradually decrease.
Take measurements to find the time *t* for the voltmeter reading to decrease to 2.0V after the switch is opened.
Record *t*.

t = ...[2]

(c) Repeat **(b)** with different resistors in the component holder until you have six sets of values of S and t.
Include values of $\frac{1}{S}$ and $\frac{1}{t}$ in your table.

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[10]

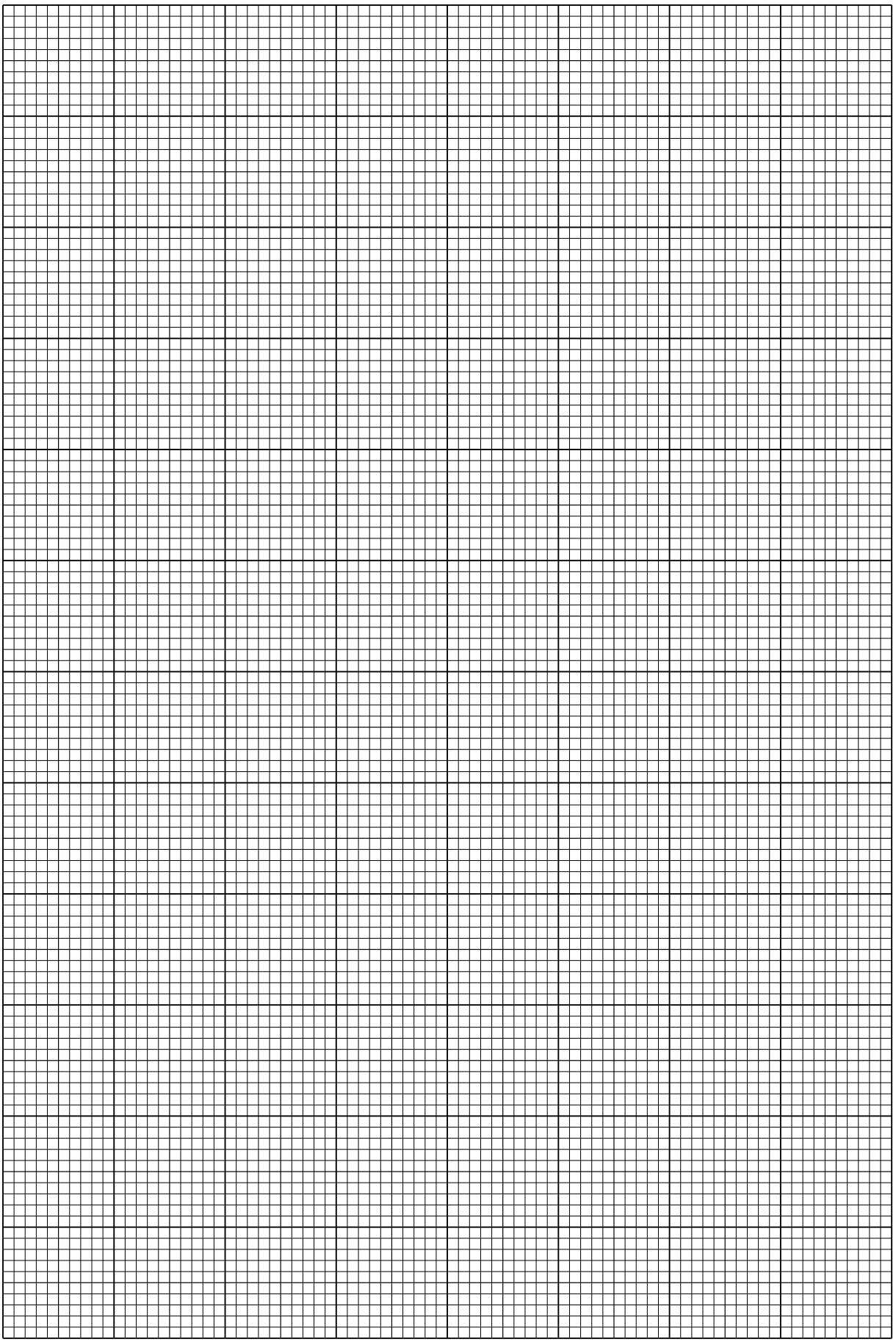
(d) **(i)** Plot a graph of $\frac{1}{t}$ on the y-axis against $\frac{1}{S}$ on the x-axis. [3]

(ii) Draw the straight line of best fit. [1]

(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...
[2]



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(e) The quantities t and S are related by the equation

$$\frac{1}{t} = \frac{a}{S} + ab$$

where a and b are constants.

Using your answers from **(d)(iii)**, determine the values of a and b.
Give appropriate units.

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a = ...

b = ...

[2]

Please turn over for Question 2.

You may not need to use all of the materials provided.

For Examiner's Use

2 In this experiment, you will investigate the relationship between the volume of a bubble of air in water and the diameter of the tube that produces it.

(a) You are provided with a syringe connected to a length of plastic tube which has a smaller tube sealed into its end with Blu-Tack.

(i) Take measurements to determine the internal diameter *d* of the smaller tube.

d = ...[2]

(ii) Estimate the percentage uncertainty in your value of *d*.

percentage uncertainty = ...[1]

(b) **(i)** Position the plunger at the 5 ml mark on the syringe. Check that there is no water in the syringe or tube.

(ii) Immerse the end of the tube approximately 2 cm below the surface of the water in the beaker, as shown in Fig. 2.1.

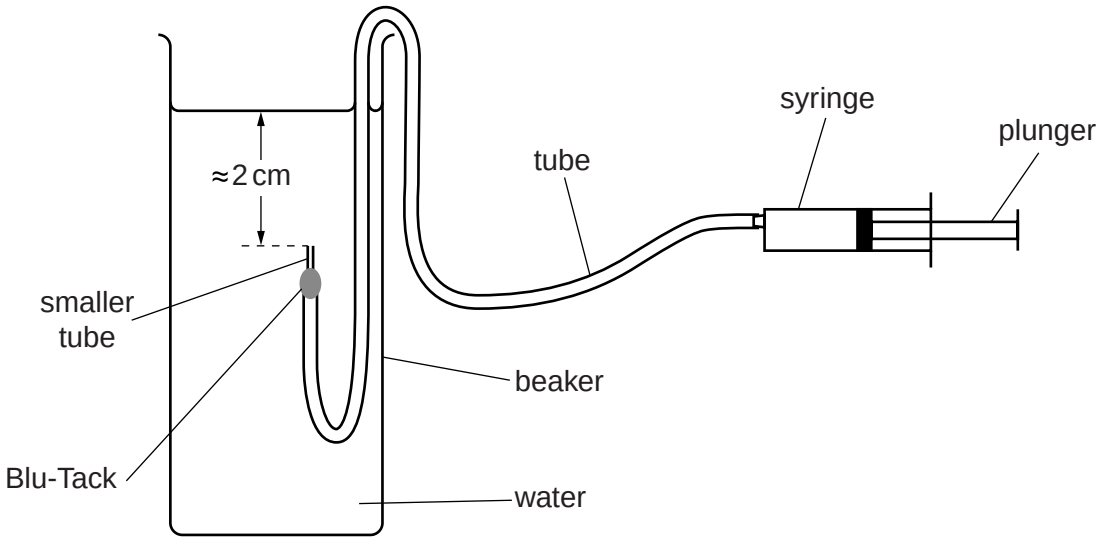

Fig. 2.1

(c) **(i)** Slowly push in the syringe plunger until it is just past the 4 ml mark on the syringe barrel.
Record the reading r_1 from the syringe. (Note that 1 ml = 1 cm^3.)

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r_1 = ...cm^3 [1]

(ii) Count the number n of bubbles that are produced as you slowly push in the plunger until it is just past the 2 ml mark. Record n and the new reading r_2 from the syringe.

n = ...[1]

r_2 = ... cm^3

(iii) Calculate the average volume V of air in a single bubble using the relationship

$$V = \frac{r_1 - r_2}{n}.$$

V = ... cm^3 [1]

(d) Justify the number of significant figures you have given for your value of V.

.....

.....

.....[1]

(e) **(i)** Take the tube out of the beaker and remove the smaller tube and Blu-Tack from the end.

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(ii) Take measurements to determine the internal diameter d of the length of tube still attached to the syringe.

d = ...[1]

(iii) Repeat steps **(b)** and **(c)**.

r_1 = ...cm^3

n = ...

r_2 = ...cm^3

V = ...cm^3
[2]

(f) It is suggested that the relationship between V and d is

$$V^3 = kd^2$$

where k is a constant.

(i) Using your data, calculate two values of k.

first value of k = ...

second value of k = ...
[1]

(ii) Explain whether your results support the suggested relationship.

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.....

.....

.....

.....[1]

(g) (i) Describe four sources of uncertainty or limitations of the procedure for this experiment.

1. .....

.....

2. .....

.....

3. .....

.....

4. .....

.....

[4]

(ii) Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1. .....

.....

2. .....

.....

3. .....

.....

4. .....

.....

[4]

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